Biological_control_in_greenhouses

Demetra Prophetou-Athanasiadou
Professor
Faculty of Agriculture
Aristotle University of Thessaloniki
GREECE

tel 00302310 998843

Control Strategies

- Biological
- Cultural (Mechanical/Physical)
- Chemical (Pesticides)

Biological Control

The use of any living agent to suppress pest populations

- Predators
- Parasitoids
- Bacteria
- Fungi
- Nematodes

Pests in Greenhouses

1. Aphids
2. Scales Mealybugs (soft scales)
3. Thrips
4. Leafminers
5. Mites
6. Nematodes

1. Phytopathogenes

Green Peach Aphid on Peppers

Honeydew

Honey Dew & Sooty Mold

Aphid Monitoring

1. Check as many plants as possible
2. Look at terminal buds and lower leaf surfaces: Cast skins, honeydew, & sooty mold are indications of aphid infestation.
3. Yellow sticky traps can monitor winged aphids

Control of Aphid

- Sanitation
  - Remove weeds inside and outside of greenhouse
- Screen vents and windows
- Limit the use of quick-release fertilizer
- Beneficial Insects
  1. Green lacewings
  2. Ladybeetles
  3. Parasitic wasps

Biological Control

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Aphid Parasitoid

Parasitized Aphids by a braconid wasp

Characteristics of the Potential Biological Control Agents of Aphids

- The biological characteristics of the different groups of natural enemies microbials, predators and parasitoids
- are very diverse..

TABLE 16.1. Short overview of biological characteristics of the most important natural enemies of aphids

Group	Development time	Reproductive capacity	Specificity	Dispersal capacity
Fungi	–	–	Moderate	High
Chrysopidae	Long	High	Low	Moderate
Coccinellidae	Long	High	Low	Moderate
Cecidomyiidae	Long	Moderate	Low	High
Aphidiidae	Short	High	High	High
Aphelinidae	Moderate	High	High	Moderate

Control Agents of Aphids

Pathogens: Fungi

- The Fungi are considered the principal group of aphid pathogens, although some research has examined viruses as well.
- Fungi are good candidates for biological control as they seem very effective in both natural and experimental conditions
- and many species are highly specific to aphids
- and harmless to other beneficial and non-target organisms.
- The host dies after a few days

Control Agents of Aphids
Pathogens: Fungi

1. The fungi most usually encountered on aphids belong to the Entomophthorales (Zygomycetes);
2. they are characterized by forcibly discharged spores. Some species also form, in the host body, resting spores that lie dormant.
3. They often produce epizootics in humid conditions.
4. Deuteromycete *Verticillium lecanii* can also be found in particular environments like greenhouses

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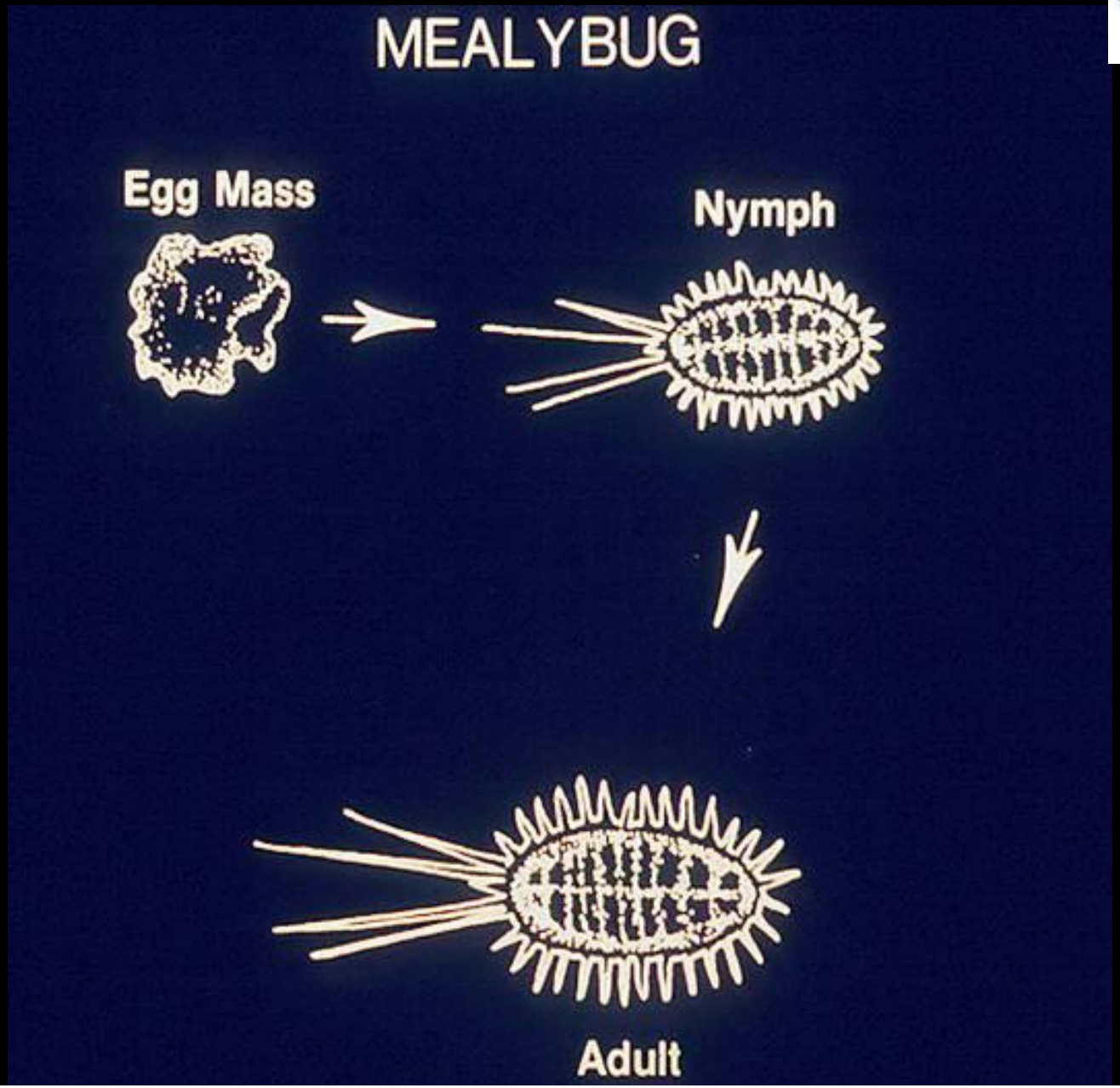
Mealybugs *Planococcus citri*

Mealybugs

1. Mealybugs lay up to 600 small, yellow eggs in a protective cottony mass. Egg-laying is temperature-dependent with fewer eggs laid under high temperature conditions.
2. Long-tailed mealybugs don't lay eggs but bear live young in a fashion similar to aphids.
3. After laying eggs over a period of 5-10 days, the female dies.
4. Female mealybugs go through 3 instars and are mobile their entire lives.
5. Male nymphs settle and spin a white, waxy cocoon. Adult males are tiny and winged.
6. One generation takes 1-3 months.

Mealybug Life Cycle



Mealybugs

Mealybug Damage

- Feed at stem tips and leaf junctures.
- Mostly on tropical foliage plants
- Stunting, yellowing, defoliation, wilting.
- Honeydew and sooty mold.
- Citrus mealybug can inject a toxin while feeding

Mealybug Monitoring

- Visually inspect leaves and stems especially at leaf nodes and joints.

Mealybugs

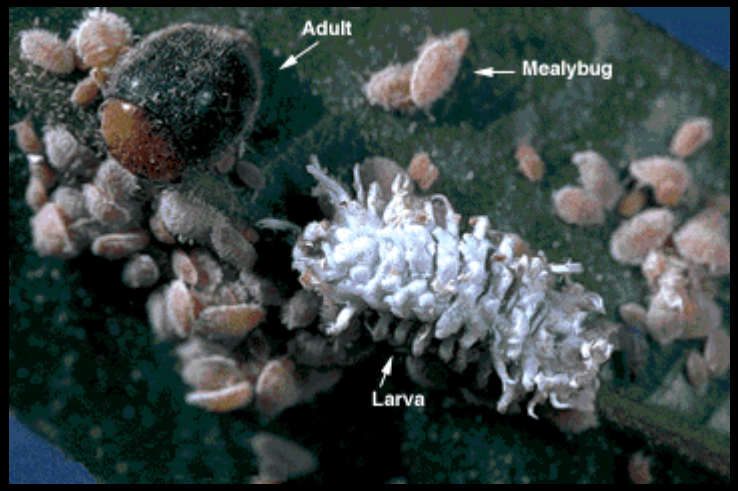
BIOLOGICAL CONTROL

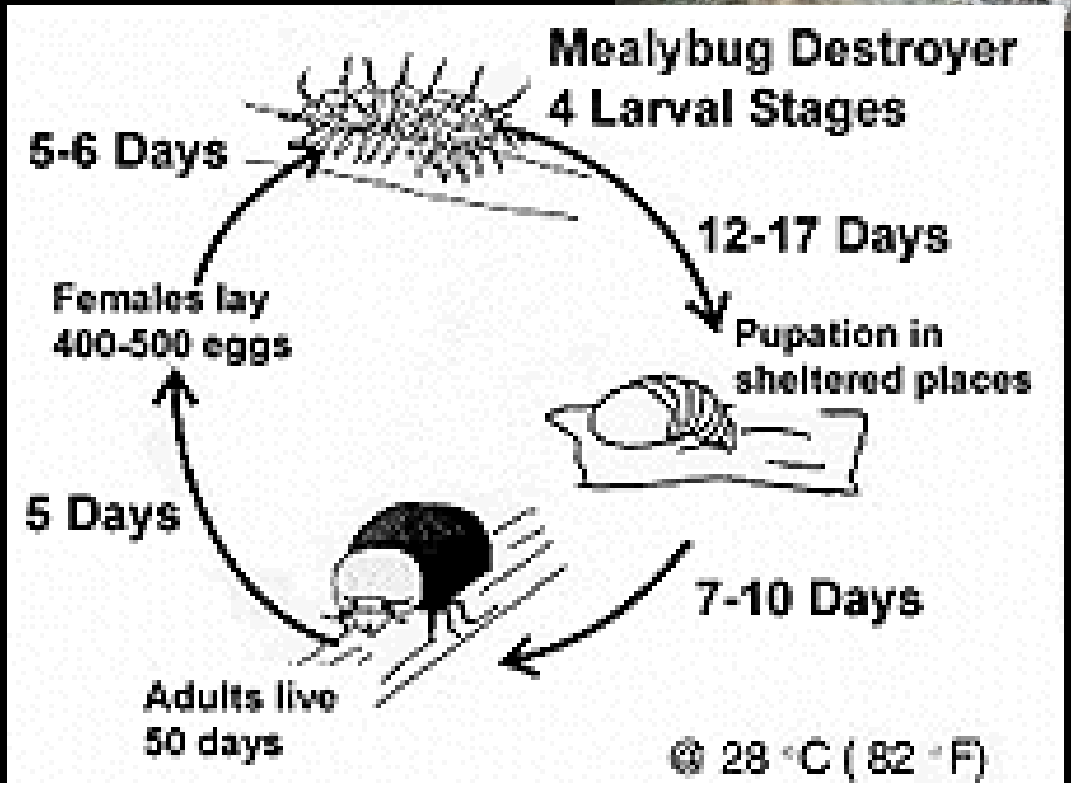
1. ladybird, *Cryptolaemus montrouzieri*
2. Parasitic wasps (*Leptomastix* spp.) are also available for use against this pest.

Mealybugs

- A ladybird, *Cryptolaemus montrouzieri*, can be released into greenhouses to control mealybugs. Note that the ladybird's larvae look like large mealybugs!
- Both the adult ladybirds and their larvae are able to find and eat mealybugs and their eggs in confined spaces on the plants.
- Parasitic wasps (*Leptomastix* spp.) are also available for use against this pest.

Cryptolaemus montrouzieri



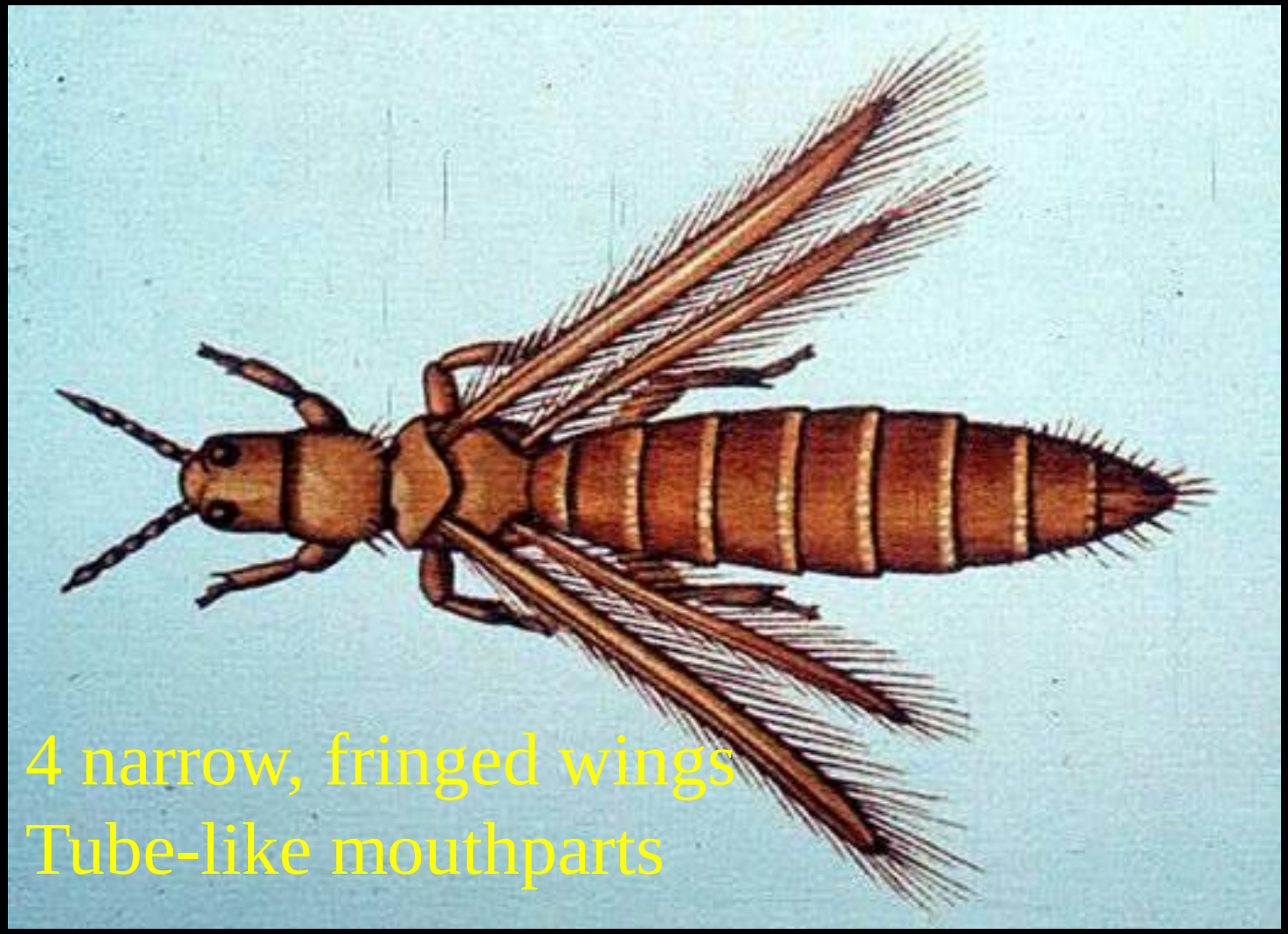


Leptomastix spp

Mealybugs

- The ladybird and parasitic wasps need relatively high temperatures
- They are susceptible to most insecticides and should therefore be used as an alternative, rather than in addition to chemical control.
- They are available by mail order from suppliers of biological insecticides

Order Thysanoptera Thrips



4 narrow, fringed wings
Tube-like mouthparts

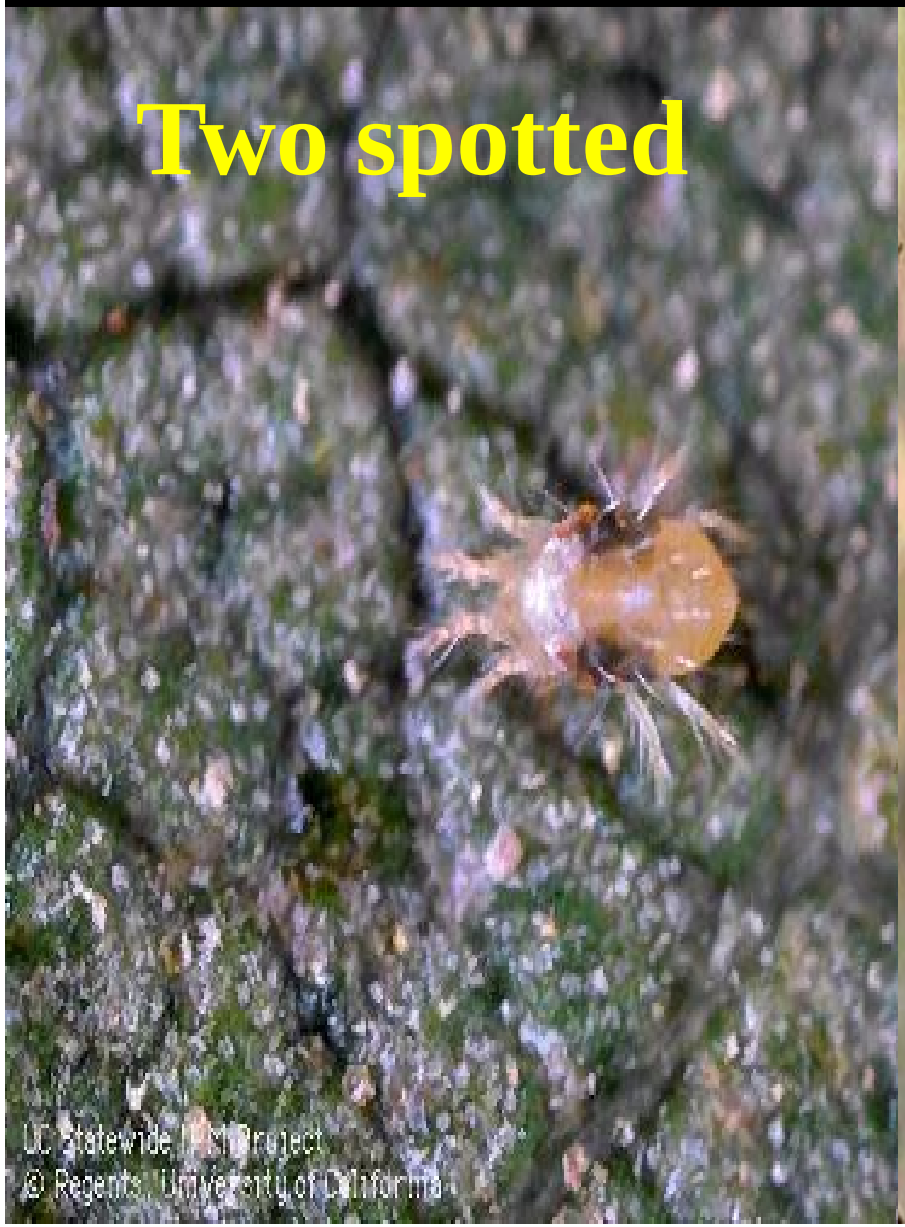
Thrips Damage

- Rasping mouthparts puncture plant surfaces.
- Egg-laying also damages plants.
- Injury appears in streaks and also as wet, varnish spots in feeding injury sites
  Petals are distorted..
- Blossoms become brown.
- Buds fail to open.
- Most of damage on flowers- and new growth
- Damagae also found on underside of leaves of foliage plants

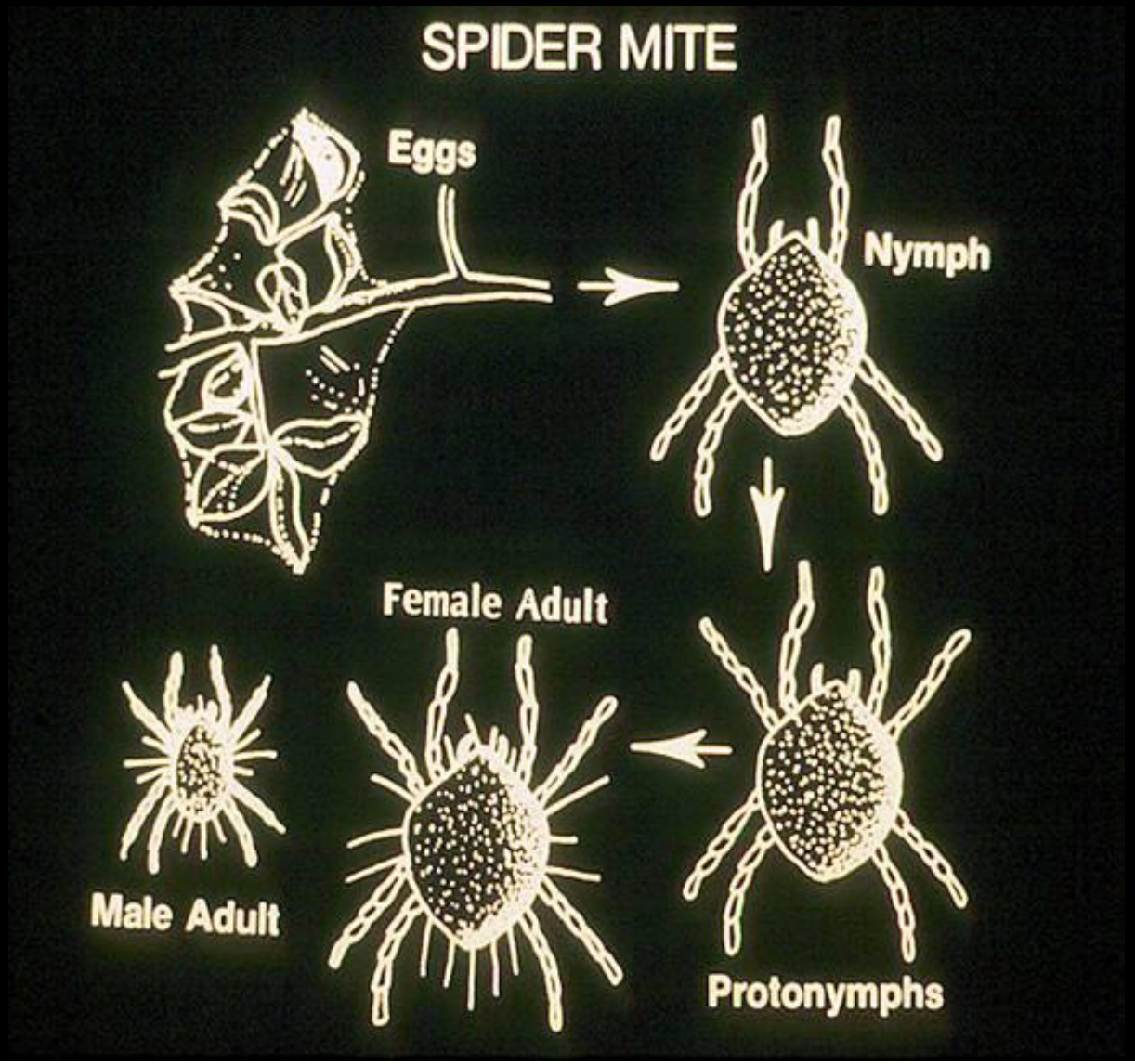
Thrips Damage on Mum foliage

Thrips Feeding on Gladiolus

Spider mites



Spider Mite Life Cycle



Greenhouse IPM

Two spotted spider mites

Tetranychus urticae Koch

Sanitation – weed control; plant inspection; reduce plant stress

Monitor – Look for stipling and webbing in warmer areas first

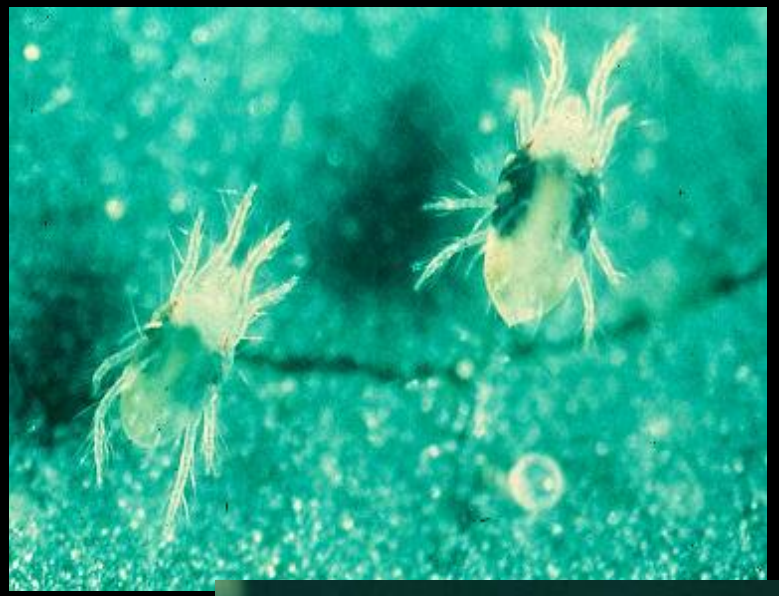
Biological control – predatory mites; multiple species available; effective temp. ranges 65 - 95°F; RH 50 – 60%

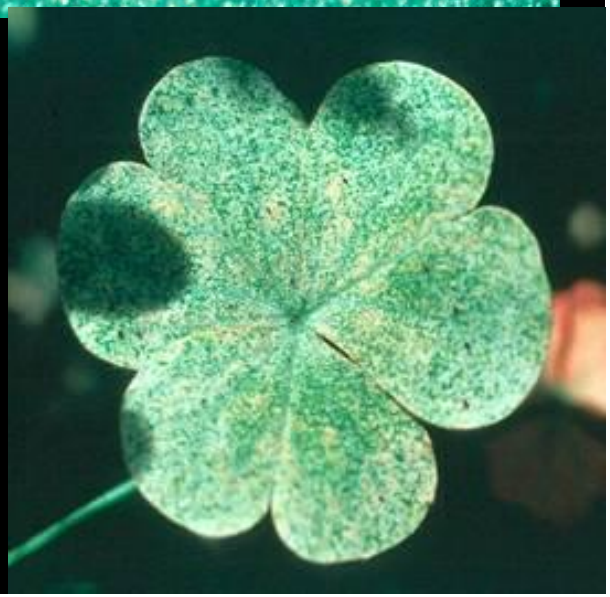
Chemical control – Hort. Oil (4 hr REI); M-Pede (4 hr REI); Floramite (12 hr REI); Akari 5SC (12 hr REI)

Phytoseiulus persimilis

Two-spotted Spider Mite

- Oval, yellow-green with two large, dark spots
- Webbing, bronzing, stippling
- Worse in hot, dry conditions
- Mites feed in protected plant parts- underside of leaves





Seed corn Maggot

Adult

Larva

Liriomyza sativa

Liriomyza trifolii-Leafminers

- Many species present
- Adults lay eggs along leaf edges
  - Will also host feed
- Damage is by larvae
  - Feed between leaf tissue layers
- Damage characterized
  - White tunnels
  - Leaf drying
  - Reduction in yield
  - Plant loss


Leafminer larva
UC Statewide IPM Project
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Leafminer tunnel
UC Statewide IPM Project
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Encarsia formosa

Six spotted thrips

Western flower thrips

Predatory Mites